Galactosemia

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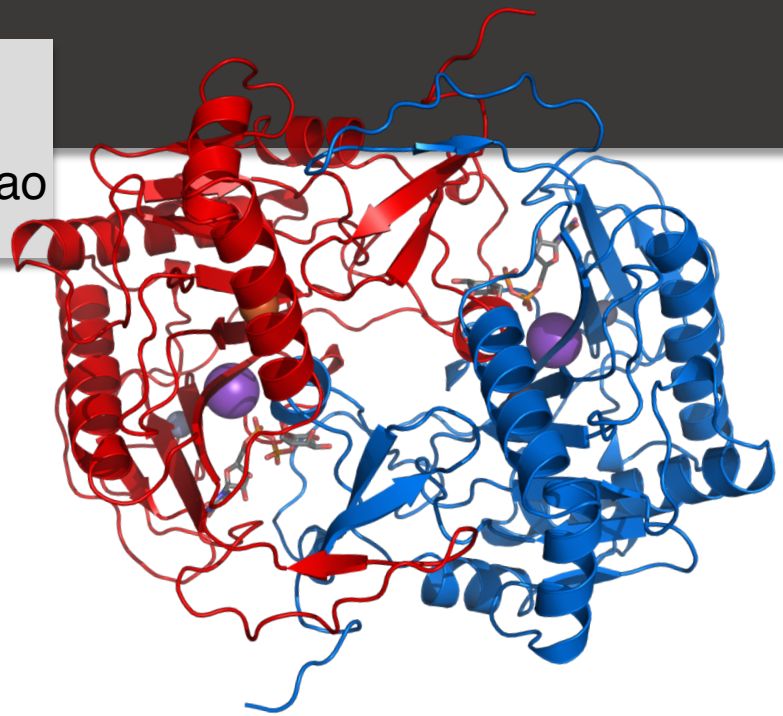
THE OHIO STATE UNIVERSITY



History

- Galactosemia first described in detail by Howard Mason and Mary Turner in 1935.

- In the 1950s, Dr. Luis Leloir and colleagues worked out the pathway for converting galactose to glucose via sugar nucleotides. In 1970, Dr. Leloir won the Nobel Prize for his work on sugar nucleotides.

- In 1988, the gene that codes for galactose-1-phosphate uridylyltransferase (GALT), an enzyme crucial for galactose metabolism via the Leloir pathway, was identified.

Digital image retrieved Oct. 27, 2019 from https://en.wikipedia.org/wiki/Luis_Federico_Leloir

Prevalence

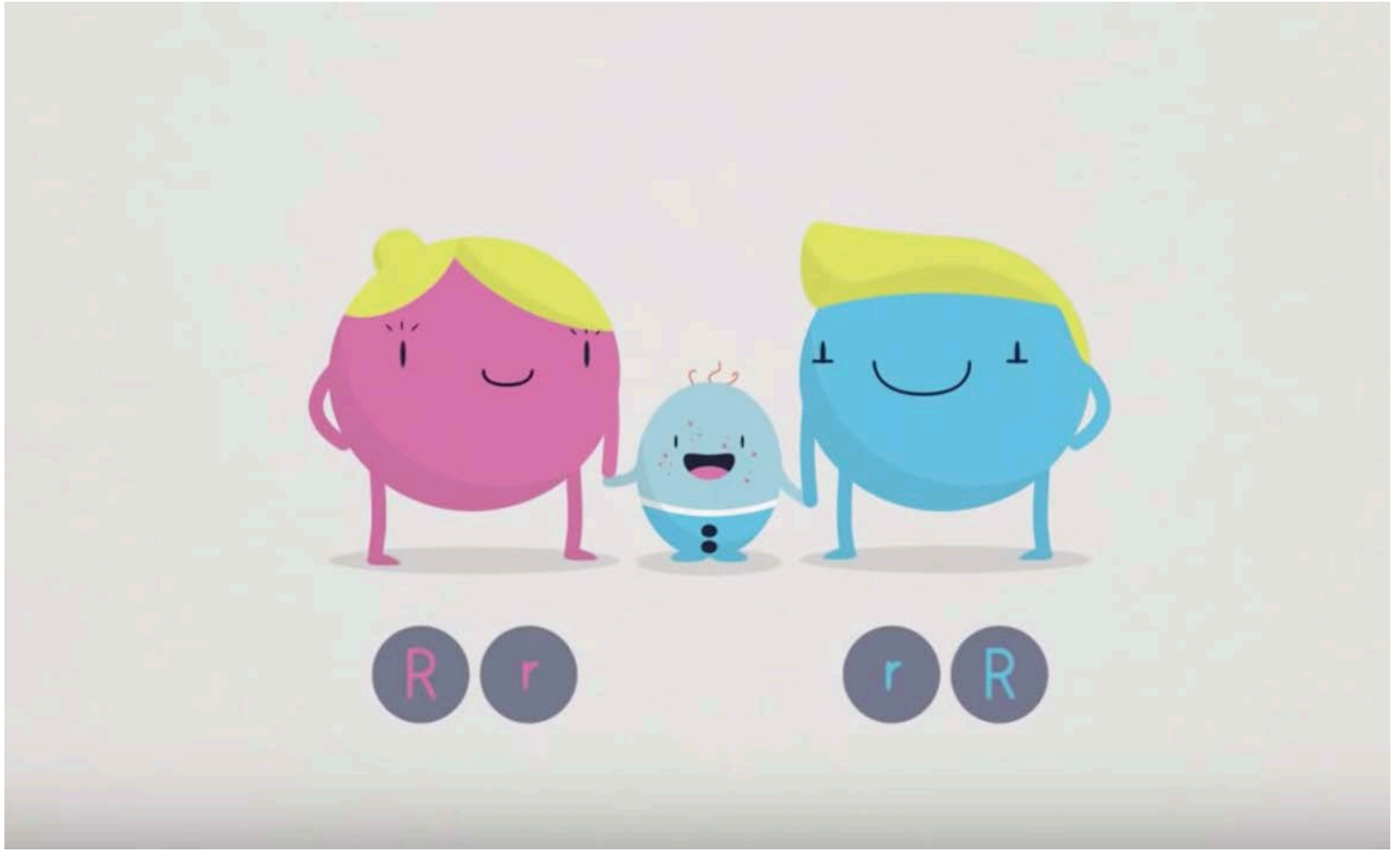
Occurrence

- Classical galactosemia (Type I, GALT deficiency) affects about 1 in 16,000-48,000 infants globally.
- Types II and III galactosemia are much more rare than classical galactosemia; they result from deficiencies in Leloir pathway enzymes other than GALT.

Provenance

- Galactosemia has no specific area of origin, but it is found in at least 24 populations of ethnic groups in 15 countries worldwide.
- Galactosemia is most common in Irish and African populations

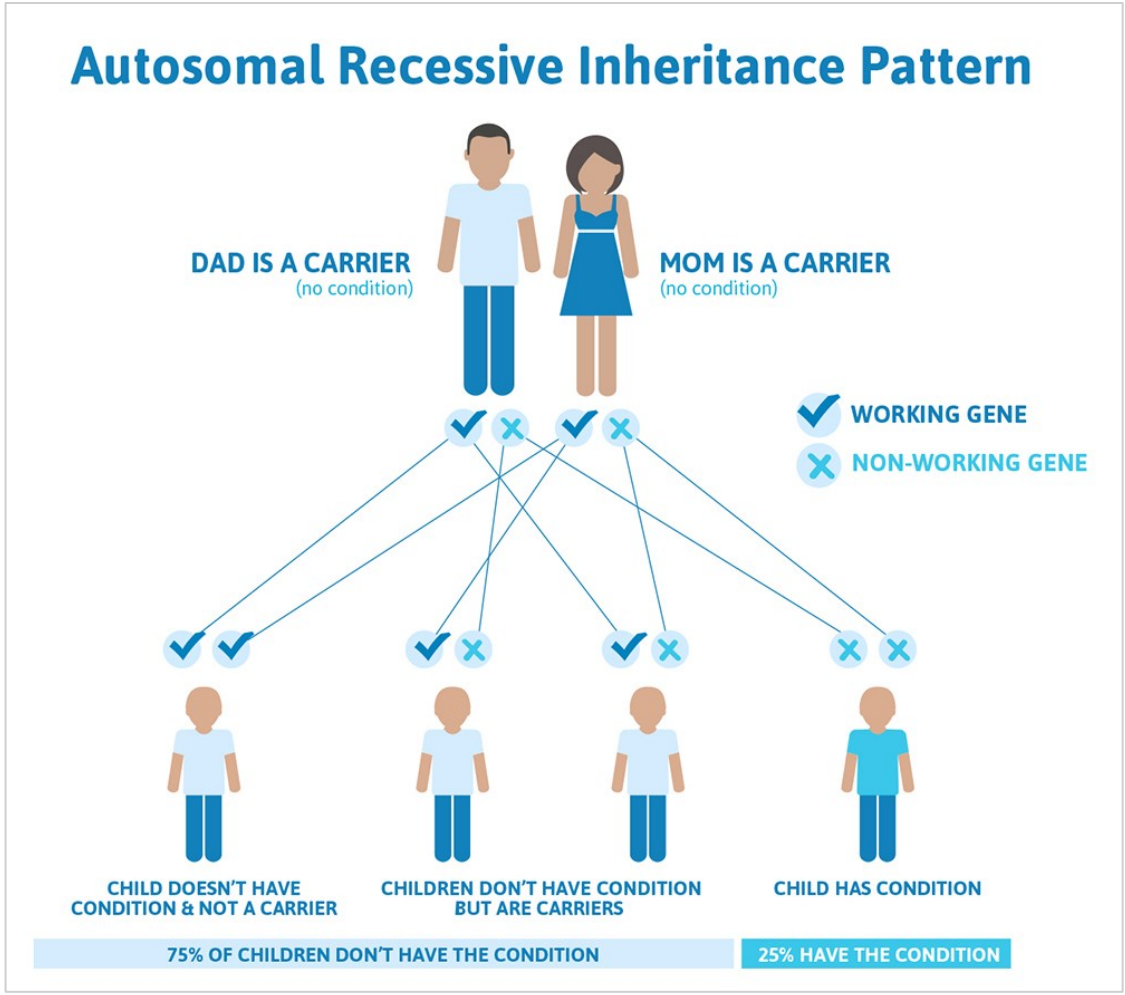
AUTOSOMAL RECESSIVE INHERITANCE



HNEkidshealth. “Autosomal Recessive Inheritance - Genetics.” Youtube, Youtube, 30 Mar. 2015, https://youtu.be/Nv6qUsKYodA?t=90

GENETICS

- Classical galactosemia is autosomal recessive, requiring two copies of the defective GALT gene.
- It is estimated that 1 in 125 people are carriers for the defective GALT gene.
- There are different mutations in the GALT gene, with varying levels of severity. Sixty percent of recorded cases are due to the most common variants of Galactosemia in the populations that were studied.

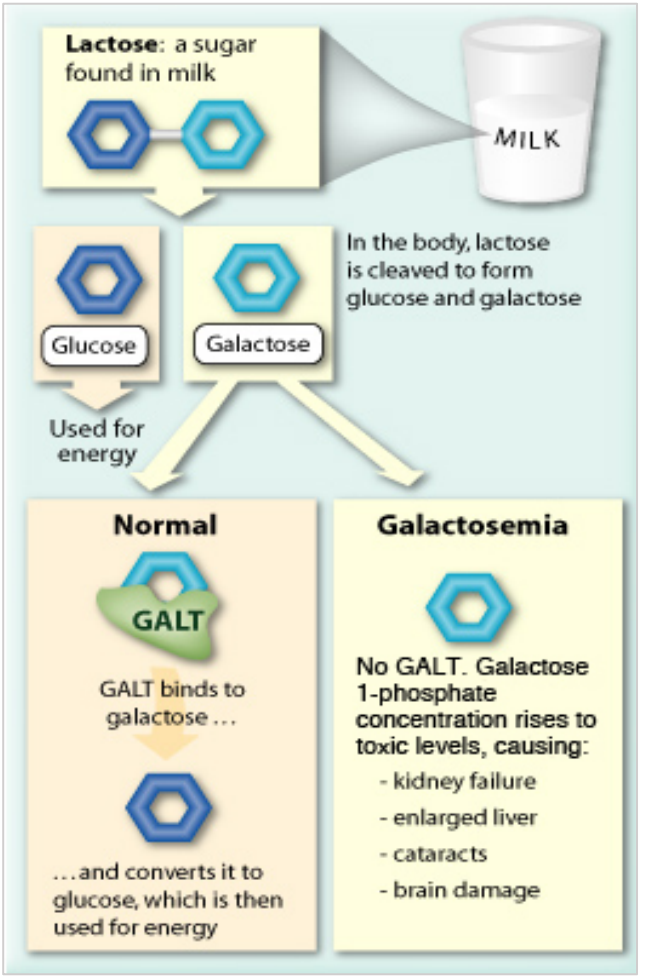


Digital image retrieved Oct. 13, 2019 from https://www.geneticsupport.org/genetics-101/inheritance-patterns/autosomal-recessive/

Classical Galactosemia (Type I)

- Inactive galactose-1-phosphate uridylyl transferase (GALT) enzyme.
  - GALT is used to process galactose, a sugar component in lactose, which is found in products like milk.

- GALT enzyme deficiency results in a ripple effect, causing the build up of different products in the blood and tissues, resulting in the associated health issues.
  - Galactitol is one product that accumulates as a result of the GALT deficiency, resulting in the formation of cataracts.



Digital image retrieved Nov. 1, 2019 from https://www.healthbenefitstimes.com/nutrition/galactose/

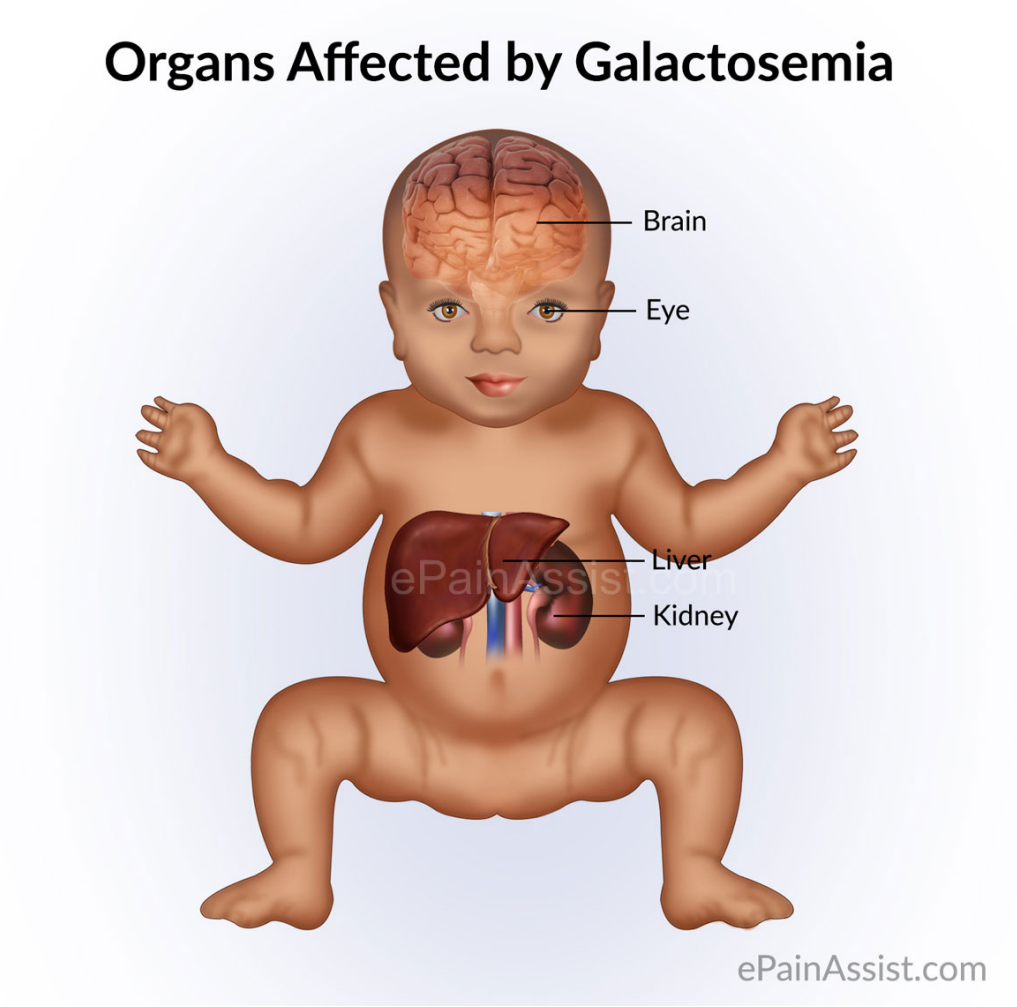
Symptoms

Initial symptoms

- Liver enlargement
- Cataracts
- Increased risk of infection
- Weakness
- Vomiting
- Jaundice

Long-term symptoms

- Intellectual deficits
- Delayed speech development
- Movement disorders
- Ovarian failure in females



Digital image retrieved Nov. 1, 2019 from
https://www.epainassist.com/genetic-disorders/galactosemia

DIAGNOSIS

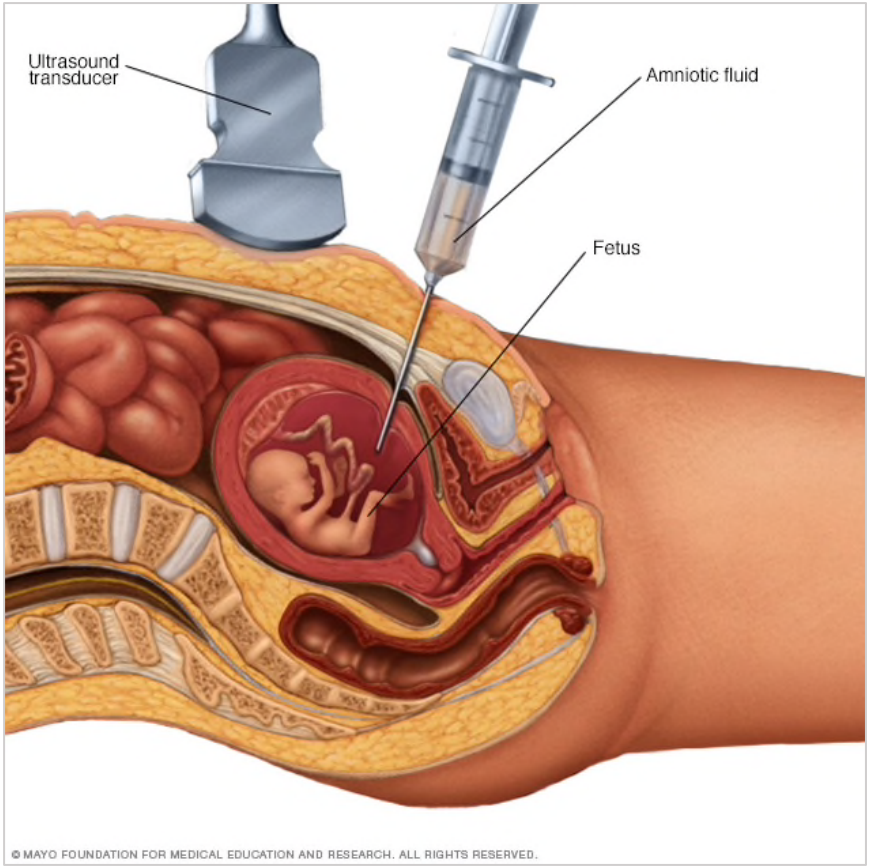
Goal: Measure GALT activity levels and buildup of reducing sugars

Prenatal (before birth):

- Amniocentesis (test sample from amniotic fluid)
- Chorionic Villus sampling (test sample from placental tissue)

Neonatal (immediately after birth):

- Blood test from infant heel
  - Supporting tests: urine test for reducing sugars and molecular genetic screening



Digital image retrieved Oct. 13, 2019 from https://www.mayoclinic.org/tests-procedures/amniocentesis/about/pac-20392914

PROGNOSIS

Classical Galactosemia:

- If diagnosed early and galactose-free diet is maintained, individuals can have a normal lifespan.
- However, individuals are still at risk for the development of many long-term symptoms and complications.
- If treatment is not prompt and consistent, severe complications and irreversible intellectual disability may occur.

THERAPY

Diet*

- Immediate switch to soy-containing formula
- Omit galactose-containing foods:
  - Animal milk
  - Yogurt
  - Cheese
  - Other dairy products
- Omit medications containing:
  - Whey
  - Casein
- Supplement nutrients lost due to diet changes:
  - Calcium and Vitamin D

*Currently, diet is the only treatment for galactosemia

Digital image retrieved Nov. 10, 2019 from

https://foodstruct.com/list/foods-high-in-galactose

- **Other types of therapy:**
  - Speech therapy and Individualized education
  - Physical Therapy

Available Support

Galactosemia Association of Midwest America

- Non-profit organization based in Wilmington, Illinois aimed at supporting families in the US mid-west who have children affected by galactosemia
- Organizes fundraisers for research and scholarships as well as socials to help connect and educate affected families

Galactosemia Foundation

- A nationwide organization that provides resources for affected families including dietary guidelines and a network of families, clinicians, and researchers

Digital image retrieved Oct. 14, 2019 from https://www.dovemed.com/healthy-living/health-resources/galactosemia-foundation/

GALACTOSEMIA: PROJECT TEAM

Name	**Project**
Kelly Murphy (Text)	Biochemical features
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Alexis Vance-Townsend (Illustrations)	Therapy
Dayne Goss	Biochemical features
Jonathan Irvin	History
Matthew Fazio	Occurrence and provenance
Olivia Warner	Genetics
Pingyi Gao	Symptoms
Anthony Sanderell	Support